STAGE LIGHTING GUIDE

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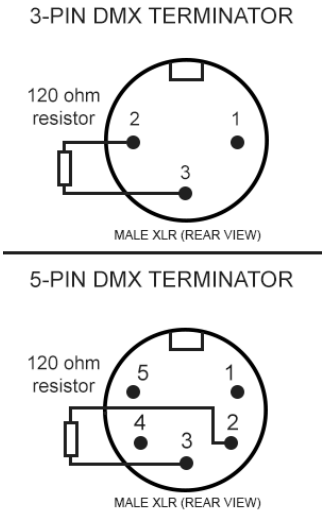
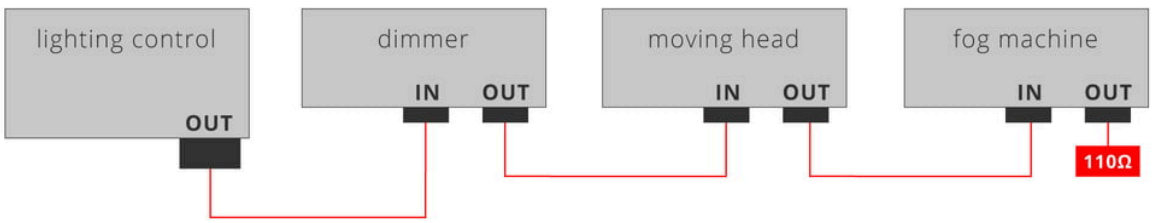
BASICS

Stage lights are usually controlled through DMX protocol. Traditional DMX protocol uses a **signal cable** that goes from the controller to every light, most commonly through “daisy chaining”.

The signal is passed from one light to the other until the end of the chain. It is a good practice to plug a “terminator” plug at the end of the chain to prevent noise in the signal (unexpected flickering of the lights). The terminator plug is just an XLR connector with a 120ohm resistor between pins 2 and 3.





CABLES

DMX cable might look like microphone cable, but it is of higher quality. Important: You **can** use a DMX cable as an audio cable, but you **cannot** use a microphone cable as a DMX cable. It might work for short runs, but microphone cables will distort the DMX signal and you might get flickering and signal drop-outs. On the other hand, **DMX cables are excellent for microphones**, but some DMX cables lack the ground connection, so if your microphone is phantom powered (most aren't), in some cases it might not work with the DMX cable.

DMX ADDRESSING

One DMX line can carry up to 512 channels, which is often plenty for small productions.

LED lights often use several channels to control the color mixing.
Example: ch 1 = red
ch 2 = green
ch 3 = blue
Each light must have a **start address**, which is basically the number of the first channel.
Example: If the **start address is 7**, then the light's channels will be:
ch 7 = red
ch 8 = green
ch 9 = blue

Start addresses are often defined on the lights using DIP switches or through a menu system. Make sure to **read the manual** for your controller and for each of the lights, to set the addresses correctly. You can find many manuals online. Just type in the name of the device + manual

EXAMPLE SETUP

LED light no. 1 (start address = 1, mode: 3 channel, RGB)	
DMX channel 1	red
DMX channel 2	green
DMX channel 3	blue
LED light no. 2 (start address = 4, mode: 3 channels, RGB)	
DMX channel 4	red
DMX channel 5	green
DMX channel 6	blue
LED light no. 3 (start address = 7, mode: 6 channels, RGBWA+UV)	
DMX channel 7	red
DMX channel 8	green
DMX channel 9	blue
DMX channel 10	white
DMX channel 11	amber
DMX channel 12	ultraviolet

You can also use **multiple lights with the same start address**! This just means they will act together, showing the same color, and you will not be able to control them individually. It is important that they are both of the same type or that they have identical channel layout (e.g. RGB, RGBW...).

CONTROLLER (also CONSOLE or DESK)

The picture below shows the most generic DMX controller. They are literally everywhere. Each slider on this controller corresponds to one DMX channel. Sometimes there's a MASTER slider that controls the overall brightness of everything. Make sure the master slider is all the way up, otherwise, you will not get any light!

Showtec Easy 16

While being most common, these controllers are not very practical, because it is not very intuitive to mix red, green and blue to get different colors. For example, it might be easy to mix red and green to get yellow, but to get warm white or pink or lavender you would need to mix all the colors in the right amount, which can get tricky. It is also a bit hard to wrap your head around the fact that slider 4 controls the first channel of the second light, slider 5 controls the second channel of the second light etc. For that reason, lighting designers usually tape a piece of painter's tape under the sliders and write which slider controls what, like so:

1	2	3	4	5	6	...	MASTER
red	green	blue	red	green	blue		
LED light no. 1			LED light no. 2			...	

Controllers like the following are also very common. Unlike the previous one, this one makes it simpler to control lights with many channels because each light gets a separate “page”, so the first slider always controls the first channel of that particular light fixture. You can choose which light you’re controlling by pressing one of the buttons on the left.

generic DMX-192

“Scanners” refers to the lighting fixtures (because the first moving lights were called scanners). The controller assumes very specific start addresses, so if you use this controller, you must set the start addresses of your lights to these fixed addresses. Read the manual to find the exact layout of the channels.

Example: this controller assumes there is 12 lighting fixtures (i.e. LED lights), and each light can have up to 16 channels. You can still use lights with less channels, they will just remain unused. The following table shows the start addresses for each LED light:

“Scanner” number	**Start address for the light**
1	1
2	17
3	33
…	…

SPECIAL CONTROLLERS

eurolite DMX LED EASY Operator Deluxe

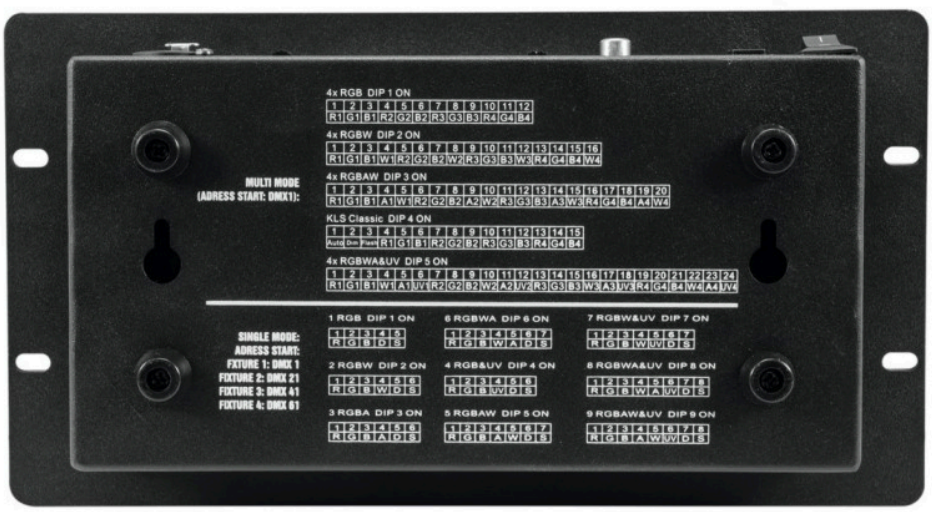
Special controllers like this are a bit rare, but they are becoming more and more popular due to their low price. This one allows you to control 4 lights (or groups of lights! remember: you can have multiple lights on the same address). The neat thing about this one is that you don’t have to do the color mixing by hand. You simply turn the color knob. This can also be a downside, since you can’t get custom colors, but only those that are built in. As the previous one, this one also has a fixed channel layout, but you can choose between several layouts. We will explore this particular controller in the next section.

EXAMPLE SETUP

In the rest of this booklet, we will explore the functions of the above mentioned controller, **eurolite DMX LED EASY Operator Deluxe** and two types of LED fixtures. Let's say we have 2 lights in RGB mode and 2 lights in RGBWA+UV mode. Now we have to choose the right channel layout on the controller.

This controller assumes we have lighting fixtures with identical channel layouts, but we have 2 different types: RGB and RGBWA+UV. We notice that the first 3 channels control the same color: red, green and blue. So now we have 2 options: setting the controller to an RGB layout or setting the controller to an RGBWA+UV layout. If we choose the RGB layout, then we can't use white, amber and UV leds for color mixing, but we still have red, green and blue. If we choose RGBWA+UV, the RGB lights are simply going to ignore the WA+UV part, but some colors might not work correctly (e.g. white will not get mixed into red+green+blue).

Let's look at the back side of the controller:


4x RGB DIP 1 ON
4x RGBW DIP 2 ON
MULTI MODE
(ADRESS START: DMX1):
4x RGBAW DIP 3 ON
KLS Classic DIP 4 ON
4x RGBWA&UV DIP 5 ON
SINGLE MODE:
ADRESS START:
FIXTURE 1: DMX 1
FIXTURE 2: DMX 21
FIXTURE 3: DMX 41
FIXTURE 4: DMX 61
1 RGB DIP 1 ON
6 RGBWA DIP 6 ON
7 RGBW&UV DIP 7 ON
2 RGBW DIP 2 ON
4 RGB&UV DIP 4 ON
8 RGBWA&UV DIP 8 ON
3 RGBA DIP 3 ON
5 RGBAW DIP 5 ON
9 RGBAW&UV DIP 9 ON

We see there is MULTI mode and SINGLE mode. What's the difference?

MULTI MODE is intended for compact light arrays, where you have 4 independent lights in one unit. The start addresses are packed together:

fixture	start address	channels
LED light no. 1	1	1 = red
		2 = green
		3 = blue
LED light no. 2	4	4 = red
		5 = green
		6 = blue
...	...	...

If we use the RGB layout in MULTI mode, it won't be good for our example because our RGBWA+UV lights use 6 channels, so they will pick up the neighbouring channels that weren't meant for them. See illustration:

	what controller sends		what the light thinks	
1	red	RGB light no. 1	red	RGBWA+UV light
2	green		green	
3	blue		blue	
4	red	RGB light no. 2	white	
5	green		amber	
6	blue		ultraviolet	

The controller thinks channels 4, 5 and 6 are red, green and blue, but our RGBWA+UV light interprets these channels as white, amber and ultraviolet. So, on the controller, if you set the color to red, you will actually get white, if you set it to green you will get amber, and if you set it to blue, you will actually get ultraviolet! Of course, you can use this, but it will be unintuitive.

The other option is to use RGBWA+UV layout, so the RGBWA+UV fixture can use all the channels, and the RGB fixture will pick up only the first 3.

fixture	start address	channels
LED light no. 1 (mode: RGB)	1	1 = red
		2 = green
		3 = blue
- unused -		4 = white
		5 = amber
		6 = ultraviolet
LED light no. 2 (mode: RGBWA+UV)	7	7 = red
		8 = green
		9 = blue
...		...

SINGLE MODE is different in a way that it leaves empty channels between each fixture:

fixture	start address	channels
LED light no. 1	1	1 = red
		2 = green
		3 = blue
		4 = white
		5 = amber
		6 = ultraviolet
		7 = dimmer
		8 = strobe
- unused -		**9..20 = nothing**

LED light no. 2	21	21 = red
		22 = green
		23 = blue
...		...

Maybe you noticed that there are two functions we haven't mentioned.

Dimmer and strobe. Some LED lights have an additional dimmer channel that controls the overall brightness of that lighting fixture. There can also be a strobe channel that turns on the strobe (rapid flashing) and controls the speed of the strobe. If the LED light has a dimmer channel, then it is **very important** to turn it up, otherwise you will get **no light** if you just try mixing the red, green, blue etc. The dimmer channel must be set above zero. The previously mentioned controller handles this for you if you use the SINGLE mode. Just make sure to turn up the master knob on the controller!

SCENES AND CHASES

There are two knobs on this controller. One labeled SCENES and one labeled CHASES. What are these? The terminology is quite old and it might be confusing nowadays. **SCENE** is a static "look" that you can save into the controller. A scene defines all the colors and intensities of all the lights. **CHASE** is a dynamic "look", the lights change at a defined speed and can be synced to music. A chase is a collection of scenes.
This controller allows you to save up to 12 chases and each chase can have up to 12 scenes.

A chase is activated by pressing the **AUTO** button, which will play all the scenes saved within that chase in a loop. The speed is defined by the **SPEED** knob, and the fade between scenes is defined by the **FADE** knob.

BETTER WAY

If you want to combine static and dynamic looks in your show, e.g. one act requires a static look, and the other act requires a dynamic look, then you will encounter a problem. You used to switch the scenes manually, and all of them were a part of the same chase. But now you want to include one dynamic look, which means you have to program multiple scenes into a different chase and run that chase. It's confusing!

I propose a better way. Instead of using scenes, let's use a chase for each act, even if the chase only has one scene in it (which makes it static). This way you can always go back and make the look dynamic by adding more scenes to the chase. The terminology is getting confusing so... Let's rename it!

old term	**new term**
SCENE	STEP
CHASE	SCENE

A chase becomes a **SCENE** (regardless of whether it's static or dynamic), and the scene becomes a **STEP** because chases used to contain scenes, and each scene was effectively a step in that chase.

There are some other terms that annoy me on this particular controller, so let's rename them too:

old term	**new term**
AUTO	PLAY / STOP
USER / BANK	NORMAL MODE
FACTORY / PRESET	SPECIAL MODE

Go ahead and **use a marker on your controller**, because from this point on, we'll be using the new terminology.

NORMAL MODE AND SPECIAL MODE

If the controller is in **NORMAL MODE** (old term: USER / BANK), and you try to change the color, nothing will happen. This is because normal mode is playback only mode! It plays the saved scenes and what ever you do with the color knobs and sliders will not affect the lights.

Enter **SPECIAL MODE**. Now you can see the changes in real time. When you are satisfied with the look, you can save it by choosing the **SCENE number** (old term: CHASE) and the **STEP number** (old term: SCENE) using the corresponding knobs and then pressing the **SAVE** button.
If you want to **DELETE** that step, you can long-press the SAVE button (just press and hold it until the buttons start flickering).

Now go to **NORMAL MODE** and try switching between scenes. You should see the changes that you made. If you saved multiple STEPS, you can press **PLAY** (old term: AUTO) and then adjust the **SPEED** and **FADE** to see how the steps fade into each other.

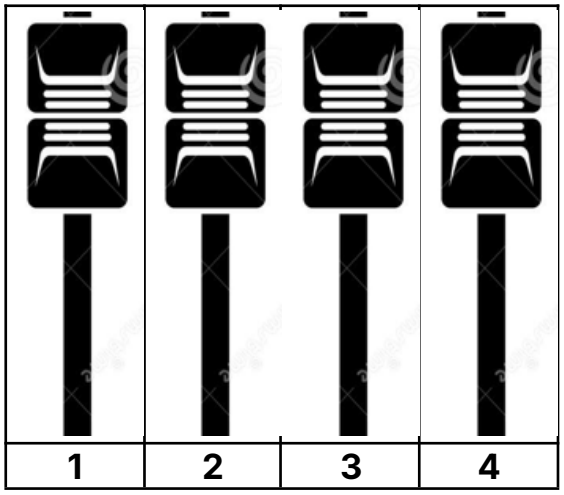
Note that the controller will play only as many steps as you saved. For example: if there are two steps saved, then it will loop these two steps.

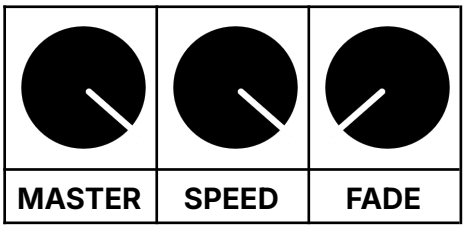
IMPORTANT!
It might happen that you forget to delete steps from a previous show, and you're now confused why the controller is playing out e.g. 5 steps instead of the 2 steps that you entered. That's because you must delete any extra steps that might be leftover. Also make sure you are pressing **PLAY in NORMAL MODE only**. If you press PLAY in SPECIAL MODE, you'll get the generic built-in presets, which are usually garbage.

The usual workflow would look like this:

1. enter SPECIAL MODE
2. set the desired colors and intensities
3. choose the SCENE and STEP number
4. press SAVE
5. switch to NORMAL MODE to compare different steps or scenes
6. go back to step 1 to make changes!

DEFAULT POSITIONS AND TROUBLESHOOTING





SPECIAL MODE

If something is not working, have you tried turning it off and on?
If it still isn't working, is there any LED glowing on the controller?
If not, you might have either a broken power adapter or a broken device.

Now if the device is in fact giving signs of life, set the controller in **SPECIAL MODE**, which will give you instant control as you tweak the knobs and sliders. Check that ALL the **buttons on the RIGHT side** are NOT glowing, they **should all be off**. Check the sliders and knobs, according to the above image - all sliders to full, **MASTER** and **SPEED** fully clockwise, **FADE** fully counterclockwise. Try changing colors (sometimes white won't show correctly on RGB lights)

WIRELESS DMX

If you hate cables as much as I do, and you're good with soldering 3 wires, you can make a wireless DMX system. I've had success with RF Nano (a cheap electronic board that is basically an Arduino Nano and nRF24 chip for 2.4GHz wireless communication). You just have to solder the power wires (5V and GND) and the RX pin to a specific place inside this controller and inside your lights. I'll write about that in a different zine and on my Github profile: github.com/kimiastrid

This publication is available online at:
https://archive.org/details/@kimi_astrid